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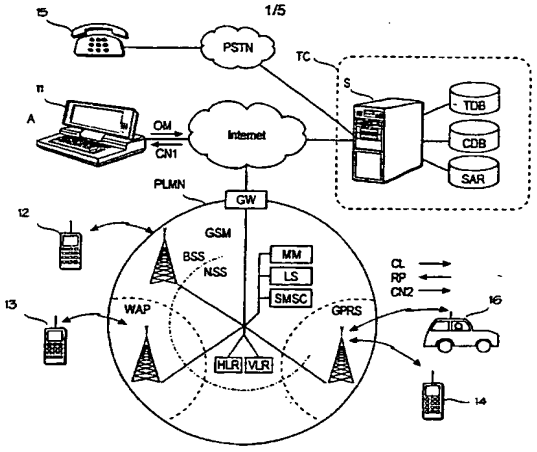
(54) Title: ORDERING OF VEHICLE, SUCH AS TAXI, OR CAR POOL



(57) Abstract: A method for ordering a taxi (16, 33) through a mobile telecommunications system (PLMN). The taxies are provided with a mobile phone of said system. In the mobile telecommunications system, location management (MM) is maintained in order to establish a connection to each mobile phone. The taxi center (TC) receives a digital order message (OM) from the subscriber terminal (11 - 14) of the client (A) and defines, on the basis of the order message, the order address of the taxi, and on the basis of said address, the taxi group (T10) which at least in the beginning is formed of taxies that are located near the order address and are in the state of readiness. Without establishing a speech connection, the taxi center sends a call (CL) to the taxies of said group. If none of the taxies answers the call within a predetermined period of time, the group is reformed, and the call is repeated. The definition of those taxies that are located in the vicinity of the order address is advantageously carried out by means of a location server (LS, LS'), where the terminal coordinates are maintained at an accuracy that is better than the accuracy produced by the location management (MM).

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Ordering of vehicle, such as taxi, or car pool

Background of the invention

The invention relates to a method and apparatus for ordering a vehicle, such as a taxi, and for organizing a car pool. In order to keep the text compact, there is mainly used the term 'taxi', but it should be understood that the term is used in a wide sense to mean any vehicle that can be ordered for the transport of people, animals and/or goods. In addition to a normal taxicab for transporting people, the term 'taxi' also means a special taxi (for instance a service taxi for disabled people), a minibus or a full-size bus, a messenger bicycle etc. In addition to a commercial taxi for one person/person group, the invention can also be applied to organizing common taxies for several people (so-called "dial-a-ride" taxies), and even for organizing voluntary car pools (without payment).

The EP patent application 0 849 964 (Bannery et al.) discloses the following method for ordering a taxi:

a) the client calls the telephone number of the service;
b) the geographical area of the client's call is detected;
c) a general call is sent to all free taxies that are located in the vicinity of said detected area;
d) one of the taxies accepts the general call, whereafter the sending of the general call is stopped;
e) there is established a direct telephone contact between the client and the taxi that accepted the general call;
f) the operator validates the operation between the client and the taxi, which procedure finally stops the process;
g) as an alternative, in case validation is not performed, the steps a - f are repeated.

The drawback in the above described method is that the ordering of a taxi requires that both parties, i.e. the client and the taxi driver, must speak. Answering the call and making notes may disturb the driver's concentration in traffic. The client, i.e. the user of the service, in turn may be in a situation where it is either forbidden or socially unacceptable to speak in a telephone,

particularly in a mobile phone. This kind of situations are for example public performances, such as concerts.

Another drawback or limitation is that according to said application EP 0 849 964, in step b) thereof, the geographical location of the client's call is defined on the basis of the cellular architecture of the GSM system. Respectively, the group of free taxies situated in the vicinity, step c) of said application, is likewise defined on the basis of the cellular architecture of the mobile phone system. Thus it is required that the operator of the taxi center also is an operator of the radio network, and that the taxi and the client use the network of one and the same operator, which is a fairly remarkable restriction.

Brief description of the invention

Consequently, a first object of the invention is to develop a method and apparatus whereby the above described problems can be solved. In other words, the invention must enable the ordering of a vehicle so that it can be carried out without speaking, both for the vehicle's driver and the client. Another object of the invention is to develop a mechanism that is free of the restriction pertaining to the prior art methods, i.e. that the operator of the taxi center must simultaneously be the operator of the radio network, and that the taxi and the client both use the network of the same operator. In other words, the taxi center according to the invention can also be realized as separate from the operator of the radio network, when desired. The objects of the invention are achieved by means of a method and system characterized by what is set forth in the independent patent claims. The preferred embodiments of the invention are described in the dependent claims.

The invention is based, first of all, on the fact that the client (the subscriber of the vehicle) sends and the taxi center receives a digital order message which directly or indirectly indicates the vehicle order address. This makes it possible to process the order address automatically in the taxi center. It is pointed out that any digital mobile phone system (such as GSM) sends digital speech packets, but a single speech packet or a combination of speech packets does not have any semantic meaning until the packets belonging to the same speech connection are conducted to a speech decoder, where a

speech signal corresponding to the original speech is synthesized. Respectively, a telefax transmission can be temporarily modified in a digital form, but a semantic meaning is created only when a human being or a character recognition program processes the received telefax at the receiving end. In the sense discussed in connection with the present invention, the sending of an order message in digital form means that the order message has a semantic meaning as such, without speech or pattern recognition.

Further, the invention is based on the fact that the order address, indicated directly or indirectly by the digital order message, is used for defining the group of taxies or other vehicles to which the order is transmitted. According to the invention, the mobile management system is not at all needed in order to define the location of the subscriber. Thus it is possible to eliminate the prior art restriction that the taxi center operator is simultaneously the operator of the radio network, and that the taxi and the client must use the network of the same operator.

It is well-known that to feed the vehicle order address (and other special wishes, such as the destination addresses of animal or group transport) in digital form by mobile phone is a cumbersome task. In known mobile phone based on-line business solutions - in case an address in general is needed - the client's address is the home address of the mobile phone subscriber, and it does not have to be sent by mobile phone. While ordering a taxi, however, it is not possible to apply a system where the order address is automatically equal to the home address of the client, because the order address is dependent on the location of the client at the time in question. According to the preferred embodiments of the invention, the feeding of the order address is made easier for example by using short addresses, as will be explained in more detail below.

In addition to avoiding speech contact, the fact that the client sends the order address to the taxi center in digital form results in many other advantages, too. With modern mobile stations, the user can write short messages and corresponding messages in advance. In the case of the exemplary public function, such as a concert mentioned above, the user can write the taxi order in advance in the mobile phone (in the short message

memory), and when the function is over, the already written order can be sent rapidly and without disturbing other people. Moreover, the digital sending of the order address also is suited for people with speech or hearing disabilities.

In case the taxi center operator also is the mobile system operator, the operator does not have to pay for sending the orders, in which case the pressure towards optimizing the target group of taxies is not very high. But if the taxi center operator has to buy the message service from the operators of one or several mobile telecommunications systems, it is important to optimize the target group of taxies in order to minimize the signalling load and resulting expenses.

Hence the sending of the order address in digital form also enhances the optimization of the target group of taxies, because the uncertainty of the order address is minimal. (As for the technology used in the EP application 0 849 964, the uncertainty factor regarding the location of the taxi user is equal to the cell radius in the GSM system.)

Unless the order is a timed order, the target group of taxies is formed by maintaining suitable criteria of selection. (A timed order can be made for all taxies belonging to the system.) An essential criterion of selection is the proximity of the taxi with respect to the order address. Another criterion of selection is the readiness of the taxi. If an answer for the call is not received, and the call must be repeated, the criteria of selection can be alleviated. In that case, taxies that are located further and further away from the order address, and/or taxies that are occupied are accepted to the target group.

According to a preferred embodiment, the target group of taxies is optimized by means of the location services of the mobile telecommunications system. Here it is important to distinguish the terms 1location management' and 'location service'. Location management is carried out in all mobile systems in order to transmit calls to and from a mobile phone. For instance, in the GSM system the location of a mobile phone is known at the accuracy of a cell during an ongoing telephone call. In other cases, the location of a mobile phone is known at the accuracy of the location area. The diameter of one single GSM cell can be 70 km. Although cells are normally much smaller, especially in the areas densily populated, it is not an optimal arrangement to

define the locations of the client and the taxi by applying the method of the prior art (steps b and c in the application EP 0 849 964). On the other hand, location service is a new, developing service for mobile phone systems. Said service is being developed for example in the US standardization group T1P1. There are several methods for locating a mobile phone fairly accurately. For example, the mobile phone can be provided with an integrated GPS receiver, in which case it can define its own coordinates and send them to the network. A mobile phone that is not provided with an integrated GPS receiver can be located by means of triangulation, by using three (or more) base stations. However, the details of the location procedure are not relevant with respect to the present invention, and respective recommendations of the T1P1 are referred to in this regard.

Thus location management means tracing of the location of the mobile phone with respect to the location or routing areas and cell or network element identifiers. Location management is carried out in all mobile phone systems, and it is a necessary task in order to route the calls to the mobile phone subscriber. Location service in turn means tracing the mobile phone with respect to geographical coordinates. This task is not necessary for routing the calls, but it is a value added network service, or it can be used for producing value added network services.

An advantageous way to define the target group of taxies for an order is to maintain a database of coordinates, where on the basis of the taxi order address (such as a street address), corresponding geographical coordinates can be read. This kind of coordinate database can be included in the system of the taxi center itself, or the taxi center can buy the service from another service provider who maintains it (for instance for some other purpose). It is not necessary to record each and every street address in the coordinate database. If the street runs straight and has a standard density of house numbers (i.e. a standard number of houses per given distance), it suffices to record only the coordinates of the houses located at both ends of the street. The coordinates of other houses in this street are obtained by interpolation. But if there are many bends and curves in the street, and the density of house numbers varies, a moderate number of intermediate points

along the street can be recorded, the house number density between said points being sufficiently regular. It is not necessary to achieve any particularly high accuracy. The geographical coordinates of the order address are only used for defining the target group of taxies for the order. If the order address coordinates are incorrect for example for the distance of a hundred meters, this only "shifts" by a hundred meters the circle within which the taxies that constitute the target group are situated. The taxi does not arrive at a wrong address, because an explicit order is sent for the taxi in digital form.

The coordinates corresponding to the order address, which are fetched from the coordinate database, are fed to the location service of the mobile phone system. In an ideal case the geographical coordinates corresponding to the order address can be directly fed into the location service, whereafter a list of for instance n nearest taxies (where n = for example 5 - 10) is requested. If the location service does not directly offer this kind of service, for example a list of taxies that are located within a given tolerance (for instance one or several kilometers) from the order address, coordinates can be requested. In case the list given by the location service is empty, or in case none of the taxies answers the call within a predetermined period, the taxi group must be enlarged (for example by extending the tolerance and/or by waiting for some time, until more taxies arrive in the area). If, on the other hand, the list given by the location service is immoderately large (for example several tens of taxies), the taxi group must be restricted in order to reduce the signalling load.

A central concept of the invention is the definition of the vehicle group located near the order address. The term 'near' can be interpreted in several different ways. From the point of view of the user, an optimal taxi is one that arrives rapidly and is as cheap as possible. Thus a 'near' taxi can mean a taxi that is located near the order address, or a taxi that is located at a distance from where the ride takes only a short time. Naturally the system is not capable of accurately defining which taxi is nearest to the order address, but the system tries to decide which taxies are located near the order address on the basis of the obtained information and the available, restricted resources. The estimation of the duration of the ride can be realized by maintaining an experience-based

record of average driving speed in each area. This type of information is obtained for instance by following the coordinate changes of reserved taxies. In that case the confirmation sent to the client can also include an estimate of the arrival time of the taxi.

The signalling method by which the order is sent to the taxi group depends on the types of mobile phones provided in the taxies. For instance for a mobile phone of the GSM system, the order is best to send as a short message. GPRS (General Packet Radio Service) is a new service of the GSM system that is being developed. A mobile phone supporting said service does not necessarily have an ongoing call, but datagrams (data packets) can still be sent, in case it has an active session. In other words, a datagram can be sent to a mobile phone, in case it is attached to the system, and the system has established for it a PDP (Packet Data Protocol) context. The same applies to the coming UMTS system.

The terminal employed by the taxi driver can be a mobile phone of said mobile phone system. The use of an ordinary mobile phone as the terminal is advantageous, because the driver can take the terminal with him when he leaves the car. Advantageously the mobile phone is provided with a large display and at least one programmable key, so that the taxi driver can, by pressing said single key, send the taxi center a pre-programmed answer in order to signal that he accepts the call.

Brief description of the drawings

The invention is explained in more detail below, with reference to the preferred embodiments illustrated in the appended drawings, where

Figure 1 is an architecture diagram of a telecommunications system where the invention can be employed;

Figure 2 is a flowchart illustrating the basic principle of the invention;

Figure 3 illustrates a modification in the architecture illustrated in figure 1;

Figures 4A - 4C illustrate the ordering of a taxi by using various different terminals;

Figure 5 illustrates a taxi database;

Figure 6 illustrates a short address register;

Figure 7 illustrates a coordinate database;

Figure 8A illustrates a typical usage situation of the invention;

Figure 8B illustrates corresponding data structures and information flows in the case of figure 8A; and

Figure 9 illustrates the different modes and mode shifts of a taxi.

Detailed description of the invention

Figure 1 is an architecture diagram of a telecommunications system where the invention can be applied. For the sake of clarity, the invention is explained with reference to ordering a taxi 16, but it should be understood that the invention is applicable to the ordering of any vehicle that can be ordered, and therefore the term 'taxi' refers to a large group of various vehicles. Four users with four different user terminals 11 – 14 can be seen in Figure 1. The terminal 11 is a computer provided with an Internet browser. The terminal 12 is a mobile station supporting the short message function, for instance a mobile phone of the GSM system. The terminal 13 is a mobile station supporting the WAP protocol. The terminal 14 is a mobile station of a packet radio network, for instance the GPRS system. In addition to the terminals 11 - 14, it can be considered that particularly handicapped and elderly people etc. can order a taxi home by using a telephone 15 of an ordinary PSTN (Public Switched Telephone Network) of an optional network, as is explained in more detail with reference exceptional situations.

In the example of figure 1, the basic functionality of the mobile telecommunications system PLMN (Public Land based Mobile Network) is built on the GSM system (Global System for Mobile Communication). In addition, the mobile system includes two services supporting more advanced protocols, i.e. the GPRS (General Packet Radio Service) and the WAP (Wireless Application Protocol). These services are available to those users who subscribe to them and have a terminal that supports said services. The SMSC (Short Message Service Center) is the short message center of the mobile system. The BSS (Base Station Subsystem) is the base station system, and

the NSS (Network Subsystem) is the network subsystem. The reference MM (Mobility Management) refers to the location management maintained in the mobile telecommunications system, which management is required for establishing connections to mobile terminals. In the exemplary GSM system, location management is realized by means of the home location register HLR of the network and visitor location register VLR. The reference LS (Location Server/Service) refers to a location service which is not a necessary function for the establishing of a connection, but can be used in order to produce value added network services utilizing the geographical location. The mobile system PLMN is connected, via a gateway GW, to other telecommunications systems, such as the Internet. In the GSM system, the transit exchange is employed as the gateway, and in GPRS, the employed gateway is the GGSN (not separately illustrated). The details of the mobile telecommunications system represent technology well known as such by men skilled in the art, and it is not necessary to explain them in more detail.

OM (order message) is an order message received from a user terminal 11 - 14, and CN1 (confirmation 1) is a confirmation sent for user A to the effect that a taxi has received the order. CL (call) is a call sent for the taxies, RP (reply) is the taxi driver's notice to the effect that he accepts the call, and CN2 (confirmation 2) is the confirmation sent for the taxi in question. The taxi center TC according to the invention shall be explained after the explanation of figure 2.

Figure 2 is a flowchart illustrating the basic principle of the invention. In step 2-2, a digital order message is received from one of the user terminals 11 - 14. In step 2-4, on the basis of the digital order message, three parameters for the order in question are defined, i.e. 1) the order address, where the taxi is requested, 2) the point of time when the taxi is wanted and 3) the desired type of the taxi.

In a general case, the order address where the taxi is requested is explicitly written in the order message. Generally said order address is a street address. The processing of the order address can be made more versatile by implementing the processing of short addresses. A short address is an address that is easy to remember, such as "Opera", "The National Theatre", etc.

According to an advantageous embodiment, the short address "home" means the home address of the user in question, which address can be fetched from the subscriber register of the telecommunication system. Yet according to another alternative, "home" is the default address where the taxi is ordered, unless another address is given. This is particularly useful when the terminal (such as a telephone 15) is located in the home of a handicapped person, in which case the default order address is the home address of the person in question, and said address is fetched from a list maintained for this purpose, on the basis of the telephone number of the telephone 15.

Another advantageous additional feature is the free-form text field that can be used for giving driving instructions to the driver. For instance in connection with the Opera, the order address could be "Opera/back door".

The order message can also define the point of time when the taxi is wanted. In case the subscription time field is empty, the taxi is wanted immediately. In another case, the order is recorded and processed later.

The order message can also define the type of the taxi (or other vehicle). In case the type field is empty, the default type is a normal-sized taxi for 1 + 5 persons. Additional definitions describing possible special types are for example "disabled", "dog" "skis" or "minibus", as well as the total number of persons etc. Special group orders can be identified for instance by the key words "in common", "group", "pool" or "car pool".

Steps 2-6 and 2-7, indicated by dotted lines, are optional, advantageous additional features. They define whether the order is sensible, i.e. whether the order address exists and whether it is unambiguous. In case the order is not sensible, the user is informed that the street address is not found, or that the short address is ambiguous, and he is asked to make a new order. One way for realizing the steps 2-6 and 2-7 is to investigate whether the order address is found on the basis of the short address register and/or coordinate database explained in connection with figures 6 and 7.

Also the steps 2-8 and 2-9 are optional, advantageous additional features. They define whether the order is an immediate order or a timed order. In case the order is a timed order (i.e. the desired arrival time of the taxi is set to take place after a longer period than just a few minutes), the call, i.e. the

timed order, is sent to all taxies in the system independent of their location or ongoing reservations.

In step 2-10, on the basis of the order address, a group of taxies which at least in the beginning is formed of taxies located near the order address and representing the desired type, is defined. The selection of the taxies located near the order address is preferably carried out by means of the mobile system location service or server LS. Most advantageously the location server is highly advanced, so that an inquiry can be fed therein, and the answer received for said inquiry enlists all taxies that are located at a given distance from the order address (or in a simpler version: all taxies that have their geographical x and y coordinates within the given limits). In that case the location server should also independently decide which mobile phones are located in the taxies. This could be realized for example so that a given area of the numerical space is reserved for all taxies belonging to the system.

If the location server cannot independently distinguish which mobile phones are located in the taxies, a list of the taxies belonging to the system must be fed therein. This naturally causes a remarkable telecommunications load between the taxi center TC and the location server LS, wherefore it is advantageous if these elements are interconnected via a swift connection, for instance so that both are physically situated in the same high-speed local network. Thus, even if the operation of the taxi center and the mobile telecommunications system is carried out by separate operators, it is recommendable to arrange the equipment in mutual contact.

Yet another problem is the protection of privacy. Generally a mobile phone subscriber does not wish to give information as to his location for strangers. This problem can be solved for example so that the taxi drivers joining in the system give their permission for sending to the taxi center a list of those taxies who are located sufficiently near the order address. Thus it is not necessary to reveal the exact location of the taxi. This permission can be recorded for instance in the subscriber profile.

A preferred method for solving problems connected to signalling loads between the location server LS and the taxi center TC shall be explained in connection with figure 3.

If a location server is not available, an alternative solution can be a mobile system applying the microcell technique.

In step 2-12, a call is sent for the taxi group without establishing speech connection. In step 2-14 it is waited whether one of the vehicles answers within a predetermined period. In case none of the taxies answers, the next step 2-16, where the taxi group is reformed, is taken. When reforming the taxi group, the criteria of selection can be somewhat alleviated, for example by accepting taxies that are located further away and/or are reserved. Thereafter the system returns to step 2-12, where the call is repeated.

The technical realization of the call and the answer depends on the types of mobile phones the taxi drivers have. For mobile phones of the GSM system, the order can be sent for example as a short message. For mobile phones supporting the GPRS service, the order is most suitably sent as a datagram. When a taxi answers the call, a confirmation is sent both to the taxi driver and to the client. Already the fact that the taxi group is reformed may result in that one of the taxies answers the call. For example, in case the order is sent by using a connectionless protocol, the mobile telecommunications system does not know whether the sending of the order was successful, or whether the taxi was located in a dead region, etc. On the other hand, when using a connection-oriented protocol, for instance when using short messages, the mobile system obtains from the taxi an acknowledgement that the short message was received successfully, in which case the taxi center can assume that the target taxi group also has received said short message.

As was already maintained, in case the taxi center operator buys the message services from the mobile telecommunications system operator, it is important to optimize the target taxi group in order to minimize the expenses. One way for minimizing expenses is to send the call only for such taxies that are ready for receiving calls. This kind of readiness does not necessarily mean that the taxi is 'free'. In fact a taxi can receive calls already some time before the ongoing transport is ending. Technically this can be realized as follows. When the taxi driver's shift begins, he sends to the taxi center a datagram or a short message to the effect that he is in full readiness. When said taxi receives an order and the taxi center confirms the order, said taxi is automatically

marked as reserved. In addition, the taxi driver can send an explicit datagram or short message indicating the reserved mode, in case he picks up a client in the street or at a taxi stop. When the taxi approaches the destination address, the driver can send a datagram or a short message indicating readiness.

Another way to reduce message expenses is that initially the target taxi group is very small, even including only one taxi. Now respectively the time during which an answer is expected is very short. For instance, in the beginning there can be sent a call for only one taxi that is in the state of readiness, and if said taxi does not answer, the call can be sent to the next taxi already within 5 - 10 seconds.

In case the sending order of the calls is defined on the basis of the taxi driver's name, telephone number or IP address, there is danger of favoring those drivers who are placed at the top of the list. By using a random factor, orders can be balanced so that during a longer period, each driver receives an equal amount of orders. An example of a random factor is that the order is first sent to the driver located nearest to the client, then to the next nearest, and so on.

Figure 3 illustrates a modification in the architecture shown in figure 1. A particularly advantageous way to solve the problem connected to the signalling load between the location server LS and the taxi center TC is that in the taxi center, there is arranged a copy LS' of the location server to the extent where the mobile phone subscribers are taxi drivers joined in the taxi center. In practice this means that the taxi center operator cannot realize his own triangulation or other locating technique related to the location service, but the taxi center TC may obtain or buy the coordinate data of the mobile phones of the taxies that have joined the system from the mobile system operator. In that case in the mobile telecommunications system subscriber data, there is recorded a notice to the effect that the taxi driver who has joined the system has given permission to hand over his location data to the taxi center. Figure 3 shows three mobile phones that are all different from the point of view of the invention. Reference 30 represents the mobile phones of all others except the taxi drivers. Reference 31 represents the mobile phones of those taxi drivers who are not working (i.e. the car is empty). Reference 32 represents the mobile

phones of reserved taxies (there are passengers in the car). Reference 33 represents the mobile phones of taxies who are in readiness (only the driver is in the car). XY_{30} - XY_{33} represent corresponding coordinate data. Reference LI1 (LI = Location Information) represents the information flow connected to the location or coordinate data corresponding to all types of mobile phones 30 - 34, i.e. that location data that is maintained in the location server LS of the mobile system. FI1 filter is a filter for restricting the location data that is sent out of the mobile system to refer only to those subscribers (taxi drivers) who have given permission to hand over their location data. The dotted-line arrow 38 illustrates the fact that the operation of the filter FI1 is controlled on the basis of the subscriber data recorded in the home register HLR (assuming that said permission is recorded in the home register subscriber data). The information flow LI2 directed to the filter FI1 contains the coordinates of all mobile phones 30 - 34, but the information flow LI3 directed out thereof only contains the coordinate data of the taxi drivers' mobile phones 31 - 33. Thus the filter FI1 reflects a functionality that is needed in order to ensure data security connected to privacy (location). In addition, it is advantageous to use a second filter FI2, the operation whereof is controlled from the taxi center server S (arrow 39). The filter FI2 ensures that the information flow LI4 directed to the taxi center location server LS' does not include the location information of those taxi drivers 31 who are not working. (The taxi drivers' permission to hand over location data may relate only to their working period.) In addition, the signalling load between the mobile telecommunications system PLMN and the taxi center TC can be reduced by filtering away the location data of reserved taxies 32. As an alternative, the location data of reserved taxies 32 can be updated for the taxi center only fairly seldom, for example once a minute, or only when there is remarkable change, for instance several hundreds of meters, from the previous measurement.

The fact that the location server LS' of the taxi center is a filtered copy of the location server LS of the mobile system means that the situation is observed from the point of view of the element that requests information. Consequently, from the location server LS', there is obtained location data as well as from the location server LS of the mobile telecommunications system.

On the other hand, as regards the internal structure, the location server LS' of the taxi center may be remarkably simple, because all processing already has been carried out in the location server LS of the mobile system. As a matter of fact, the concrete embodiment of the location server LS' may simply include the coordinate data X and Y in the taxi database TDB, as shall be explained in connection with figure 5.

Figures 4A - 4C illustrate how a taxi can be ordered by using various different terminals. Figure 4A shows how a taxi is ordered by means of a computer 11 provided with an Internet browser. By means of the browser, the user of the computer establishes a connection to the taxi center address 400, which is for instance "www.abc-taxi.org". The taxi center sends to the computer 11 a form 402 in the HTML language, including the following fields. The order address 410 indicates the address to which the taxi is requested (departure address of the transport). In this field, there can be fed an explicit street address, or an above mentioned short address, for instance "Home" or "Opera". The optional destination address 412 tells the address where the transport is desired to end. Generally a normal taxi cab does not need the destination address in advance, but the client tells said address at the beginning of the ride. However, the destination address is needed when ordering group taxies, taxies for transporting goods, taxies for exceptionally long trips etc. The time field 414 indicates when the taxi should arrive. In case the field 414 is empty, or has a value 'immediately', the taxi is requested as soon as possible. The field 416 indicates an optional instruction for the driver, for instance "to the ground floor door", "via the street Susitie", etc. The optional field 418 indicates the client's telephone number (in case the driving instructions were not sufficient, or in case the taxi driver should have to inform that he is arriving late etc.). The field 420 indicates the type of the taxi. In this example, the field 420 contains several one-bit parameters indicating special requests.

It is pointed out that the normal use of an Internet browser does not require any kind of authentication (checking the identity of the user). However, authentication is considered to be part of the technology known by professionals in the Internet trade. A simple authentication is carried out so that

the order is performed through an optional telephone network, in which case the Internet server must transmit the telephone number to the taxi center. Another possible authentication mechanism is based on the use of chip cards.

Figure 4B illustrates how a taxi is ordered by using a WAP telephone 13. In principle, the order is placed in similar fashion as in figure 4A. The only restriction is set by the small size of the telephone display 425. Therefore the WAP form 402' is more compact than the Internet form 402, and it must be browsed in the up and down direction.

Figure 4C illustrates how a taxi is ordered by using the short message function of the GSM system. In this example, the client orders a minibus for 1 + 8 persons to the City Theater by sending to the taxi center's telephone number a short message that includes at least an identifiable first part of the order address plus the key word "1 + 8".

Figure 5 illustrates the data that maintains the information of the taxies that have joined the system, i.e. the taxi database TDB. No means the internal number in the system, i.e. file index. LIC (License plate) means the registration number of the car. ID (Identifier) is the telephone number, the IP address or another identifier of the mobile telecommunications system, by which the taxi can be contacted. The next three fields (type, skis, animal) indicate whether the order relates to a normal taxi or one for the disabled, or to a minibus or a full-sized bus (1 + 8 or 1 + N persons), and whether skis or animals can be transported. The fields that were described so far are static, i.e. their value does not generally change. The following fields are dynamic, i.e. the server S of the taxi center updates them continuously. The field 'in operation' indicates whether the taxi is working or not. The readiness field indicates whether the taxi is ready to receive orders. X and Y are the taxi coordinates which the server S updates according to the information received from the location server LS of the mobile system. In fact the coordinates X and Y, together with the updating and distance-defining logics, constitute a possible concrete embodiment for the location server LS' (figure 3).

Figure 6 illustrates a short address register SAR (Short Address Register) according to a preferred embodiment of the invention. It is much easier for the user to remember the names of public buildings, airports and

ship terminals than their street addresses. Advantageously the short address register and the connected logics in the server S function so that the user only needs to write an identifiable first part of the address in question, for instance "city theat". It would be possible to technically extend the system so that every time a mobile phone subscriber orders a taxi to the address "theater", the system could, on the basis of mobility management or location service, determine which theatre is in question. In that case, however, some of the location data of the mobile phone subscriber should be handed over to the use of the taxi center. On the other hand, in this kind of a situation the subscriber is in any case ready to tell his location, in which case the ordering of a taxi to a given address could be regarded as an implicit permission to give some of the location data of the subscriber to the taxi center.

Figure 7 illustrates a coordinate database CDB (Coordinate Database). In the coordinate database, all cities and municipalities in the service area covered by the system, as well as all postal addresses included therein, are enlisted. Figure 7 illustrates a point of the coordinate database where a street called Karhutie in Helsinki is seen (coordinates are not coordinates of any real system). Even and odd house numbers are placed in the database CDB at points where the road changes direction, or where house density varies. The coordinates between said points can be found out by interpolation. For instance the order address OA "Karhutie 123" is transformed into coordinates in the following way. In the database CDB, the next smallest odd address to the number 123 is 75, and the next largest odd address is 139. In between said addresses, the coordinates XY are obtained by linear interpolation. In addition to the coordinates, in the CDB there can be recorded the local district or its abbreviation AB (Abbreviation), like here: "H-niemi" (= Herttoniemi). The use of this feature shall be explained in connection with figures 8A and 8B.

Figure 8A illustrates a typical usage situation of the invention, and figure 8B illustrates respective data structures and information flows. Let us assume that the taxies T1 - T10 are registered in the system. The taxies T1, T3, T4 and T7 - T10 are free, i.e. in the state of readiness. In figure 8A, this is seen in that the back seat of the taxi is empty. In figure 8B, this is seen in that

the column of the taxi database TDB indicating the state of readiness at said taxi reads "1". The taxies T2, T5 and T6 are reserved (there is a passenger on the back seat, and the column indicating the state of readiness reads "0".) Client A orders a taxi to the terminal 82 of the Titanic. However, client A decides that "TITAN" is an identifiable first part of the address, and sends to the taxi center an order message OM containing the word "TITAN". As special requirements, he needs a readiness to transport skis and a dog. Thus the whole of his order message reads "TITAN SKIS DOG". The taxi center TC receives the order message and first detects the key words "skis" and "dog", which are interpreted as special requirements. The word "TITAN" is not found on the list of special requirements, wherefore the server S feeds it to the short address register SAR, which finds the order address OA corresponding to the terminal of Titanic as "Itäinen Satamakatu 54". This address is fed to the coordinate database CDB, which gives the respective coordinates XY. Said coordinates are fed to the location server LS' of the taxi center (or to the location server LS of the mobile telecommunications system, see figures 1 and 3). The location server searches for taxies located in the vicinity of the terminal 82. The nearest taxi to the terminal is T2, but it is reserved. The nearest free taxi is T3, but dogs cannot be transported. The nearest free taxi that fulfils the special requirements is T1. Although T1 is nearest to the client as the crow flies, it is located on the other side of a bay. This is apparent from a preferred embodiment of the coordinate database, in which the beam 84 is placed in between the location of the taxi T1 and the terminal, and said beam cannot be surpassed by distance measurement. The location server defines the distance of the taxi T1 from the terminal 82 by going round the beam 84 (along the dotted line 86), in which case it finds out that the distance by land from the terminal 82 is shortest with the taxi T10, and nearly as short with the taxi T7. Thus the call CL is first sent to the taxi T10. The contact information of the taxi T10 is read from the column ID (identifier) of the taxi database TDB, which column contains the telephone number, IP address or a corresponding identifier of the taxi, to which identifier the call is sent to.

At the top of figure 8B, an advantageous additional feature is seen. The fact is that it is easier for the taxi driver to work, if the short address

register SAR is used in a reversed fashion, i.e. the call only reports the short address SA. It is much easier for the driver to figure out the word "Titanic" than "Itäinen Satamakatu 54". In the taxi terminal display, this kind of short address can be shown in much larger letters than a long street address. As an alternative, an exact street address can for the purposes of the call be transformed to an abbreviation in the coordinate database CDB, as is illustrated in figure 7. There at Karhutie we can read the abbreviation AB with a value of "H-niemi", which means that Karhutie is located in Herttoniemi. This kind of abbreviation AB or short address SA suffices for the driver in order to decide whether to answer the call or not. The complete address can be sent only in connection with the confirmation of the order.

Let us next assume that the driver of the taxi T10 does not, for one reason or the other, answer the call, wherefore the call is after a few seconds sent to the taxi T7. The driver of the taxi T7 answers the call, and a confirmation CN2 is sent to him (and, when necessary, a precise street address, driving instructions etc). Simultaneously the client A receives an acknowledgement CN1 to the effect that a taxi has received the order. Advantageously the acknowledgement CN1 contains one or several of the following pieces of information: the registration number of the taxi, the telephone number of the taxi, and its distance from the order address at the moment of receiving the order. In case the order was made by using a short address, also the interpreted order address is preferably sent in a complete form, so that the client has a chance to correct an incorrectly interpreted order.

Vehicle terminal

In principle, the terminal employed in a taxi or in another vehicle that can be ordered can be an ordinary mobile station of a cellular mobile system. Thus there is no need for a separate taxi terminal. The advantages of a regular mobile phone are that it is cheap, small in size and versatile in use. The driver can easily take the mobile phone along when he goes out of the car, in order to have a cup of coffee, for instance, and still he remains within the reach of the taxi center.

However, a vehicle terminal needs some special functions at least during the time when it is used in vehicles, and especially when the terminal is used during driving. Among these special functions are 1) automatic display of a call (short message, datagram or the like) sent by the taxi center; and 2) the sending of certain messages to the taxi center by pressing the shortcut keys of the mobile phone. A shortcut key means any key (usually programmable key), so that the impression of any one key leads to the performance of the action connected thereto. When a taxi receives a call for instance in the form of a short message, the terminal must automatically display the contents of said short message. In that case, at the key that is easiest to find in the terminal device, there must be found the text "accept" or the like. In addition to displaying the contents of the call, it is good to inform the driver that a call has arrived by using a sound signal. In connection with receiving short messages, mobile phones generally do give a sound signal, but in connection with datagrams the sound signal is an additional feature. Some mobile phones support the recording of said special functions in the identity card of the user (in the GSM system in the SIM card, Subscriber Identity Module), in which case it is not necessary to make changes in the mobile phone itself. Another alternative is that in the vehicle, the mobile phone is connected to a suitable processor or to a portable computer that performs the necessary special functions.

Apart from or in addition to the fact that the vehicle terminal displays the call contents to the driver, the terminal or a computer connected thereto can advantageously synthesize the corresponding speech. In case the key for indicating that the call is accepted is placed in the steering wheel, the driver does not need to shift his vision at all in order to acknowledge the call. Instead or in addition to the call acknowledgement keys and other keys, also speech recognition can be applied.

Figure 9 illustrates the taxi modes and shifts between the various modes. A taxi has the following long-term modes: 90: not in operation; 91: free, and 92: reserved. In addition to this, a taxi turns over to the 'accepted' mode 93, when the driver accepts a call and remains waiting for the confirmation from the taxi center. The starting 93 and ending 94 of a work shift are signaled

fairly rarely. On the other hand, the shifts 96 and 97 must be carried out extremely rapidly. The shift of mode 96 takes place when the driver picks up a passenger in some other way than through the taxi center. From figure 9 it is seen that the shifts 96 and 98 are the only shifts where the driver has to make rapid decisions. Thus it suffices for the terminal that it includes two context-bound shortcut keys. In case the terminal is in contact with the taximeter of the taxi, the taximeter (or a processor controlling it) can signal the mode shifts 96 and 97 automatically to the taxi center. However, it is advantageous if the taxi driver can signal the mode shift 97 already somewhat before the transport task is finished.

According to a preferred embodiment of the taxi terminal, the order address sent to it, its possible coordinates and/or possible destination address can also be used for other purposes.

In case the taxi terminal or the computer connected thereto supports the locating and map functions, the terminal can display the coordinates of the order address, as well as the map around said area. Likewise, the order address and the destination address can be used for indicating the covered distance in the taxi receipt.

Special situations and modifications

A preferred embodiment of the taxi center according to the invention is connected to a timed order, i.e. to an order where the taxi is ordered to arrive at a specified point of time. In case the specified point of time is situated further in the future than just within a few minutes, the current state of readiness and distance from the order address are of no importance, and thus the timed order is sent for all taxies that have joined the system and fulfil the requirements, in which case the driver who is first to answer gets the order. A timed order can also be sent to drives who are not in the working shift, in case drivers wish to receive such orders.

The invention is suited also to the management of car pooling. In that case the destination address and the number of persons must be provided in the order. The taxi center server can itself, on the basis of predetermined rules, decide when the number of orders surpasses the break-even-point.

Moreover, there can be set a top limit for the waiting period, i.e. for the period during which the car pooling is realized even if the required number of persons is not found. According to yet another advantageous modification, the client can set a time limit until which the transport is realized as car pooling. If the transport is not realized as car pooling in a time limit, it shall thereafter be realized as a normal taxi ride. For municipalities, car pooling is an economical way to fulfil the requirements set forth in the law of the service for the disabled. The municipalities must provide transport services for the disabled, but they can be realized in a sensible and economical fashion. A disabled person could call a taxi simply by calling the taxi center.

Taxi stations and stops can be taken into account in the following way. In case there is a taxi stop near the order address, and there are taxies waiting, the call can first be directed to the taxies waiting at said stop. The taxi center can deduce that a taxi is standing at a stop when the taxi coordinates are essentially equal to the coordinates of the taxi stop, and when the taxi is in the state of readiness and does not move. In that case the first taxi in the line is the one who has waited longest in the state of readiness. However, the primary purpose of the system is to minimize the client's waiting time, wherefore the first call is directed to a taxi waiting at a taxi stop, in case the stop is only a slight distance further away than the nearest taxi that fulfils the requirements.

As an alternative, disabled people, elderly people etc. can order a taxi home by using a regular telephone 15 of the PSTN (Public Switched Telephone Network, figure 1). In that case, the order address can be defined as follows. The taxi center maintains a list of disabled etc. people who have a right to use the service. The list includes the telephone number and the home address of the person, and the type of taxi needed (for instance a taxi for the disabled). In this case, the digital order message OM according to the invention can be the call establishing message from the telephone 15. The call establishing message contains the number of the telephone 15, whereby the home address and the type of taxi can be defined from the list. The number of the taxi center can be programmed in one of the shortcut keys of the telephone 15.

For a man skilled in the art, it is obvious that along with the development of technology, the basic principle of the invention can be realized in many different ways. Thus the invention and its various embodiments are not restricted to the above described examples only, but they may vary within the scope of the appended claims.

Claims

1. A method for automatically ordering a vehicle through a cellular mobile telecommunications system (PLMN), when the mobile system includes several vehicles (16, T1 - T10) that can be ordered, each of which is provided with a vehicle terminal supporting at least said mobile system, and the mobile telecommunications system maintains mobility management (MM) in order to establish a connection to each vehicle terminal;

characterized in that the method comprises the following steps:

- a digital order message (OM) is received (2-2) from a subscriber terminal (11 - 15) of an ordering client (A);
- the order address (OA) of the vehicle is defined (2-4) on the basis of the digital order message;
- a group of selection criteria is maintained for forming the subset of vehicles that can be ordered, so that an essential criterion in said group of selection criteria is the proximity of the vehicle to said order address (OA);
- a subset (T10) is formed of the vehicles that can be ordered (2-10), on the basis of said group of selection criteria;
- a call (CL) to the vehicles of said subset is sent (2-12) without establishing speech connection; and
- in case none of the vehicles in the subset does, within a predetermined period of time, answer the sent call, a new subset (T7) is formed and the call is repeated.

2. A method according to claim 1, characterized in that the definition process of the proximity of the vehicle with respect to said order address (OA) comprises the following steps:

- a coordinate database (CDB) is maintained in order to transform said order address (OA) into a group of coordinates (XY);
- a location service (LS, LS') is maintained in order to define the location of the terminals better than at the accuracy produced by said location management (MM); and

- on the basis of the group of coordinates (XY) corresponding to the order address (OA), from the location server (LS, LS') a list indicating said group of vehicles is produced.

3. A method according to claim 1 or 2, characterized in that said group of selection criteria also comprises the time that the vehicle has waited in the state of readiness.

4. A method according to any of the preceding claims, characterized in that the forming of a new subset comprises alloviation of the group of selection criteria.

5. A method according to claim 4, characterized in that at first, the subset is formed of vehicles that are in the state of readiness, and in case none of the vehicles answers the call that is repeated a few times, the subset also comprises reserved vehicles.

6. An order server (TC, S) to be connected to a cellular mobile network (PLMN) for automatically ordering a vehicle (16, T1 - T10) meant for the transport of people or goods, when each vehicle that can be ordered is provided with a vehicle terminal in order to communicate with the mobile network;

characterized in that the order server comprises:

- a first set of connecting elements (2-2) in order to receive a digital order message (OM) from the terminal device (11 - 15) of a client (A);

- means (2-4) for defining the order address (OA) on the basis of the order message (OM);

- a first set of logic elements (2-10, LI4, LS', TDB) in order to define the subset (T10) of vehicles that is located in the vicinity of the order address (OA);

- a second set of connecting elements (2-12) in order to send a call (CL) without establishing speech connection to said subset (T10) of vehicles;

- a second set of logic elements (2-14, 2-16) in order to define whether one of the subset vehicles (T10)sends a reply (RP) to said call within

the predetermined period of time, and in order to form a new subset (T7) and to repeat the call, in case an answer is not received; and

- a third set of logic elements (2-20) in order to send a first confirmation (CN1) to the client (A) and a second confirmation (CN2) to the vehicle (T7) that first sent its reply (RP).

7. An order server according to claim 6, characterized in that the first set of logic tools (2-10, LI4, LS', TDB) comprise:

- a coordinate database (CDB) in order to transform said order address (OA) to a group of coordinates (XY);

- a location server (LS') in order to define the location of the vehicle terminals at an accuracy that is better than the accuracy produced by the mobile network location management (MM).

8. An order server according to claim 6 or 7, characterized in that the elements for forming the order address (OA) include a short address register (SAR) in order to transform a short address (SA) to an order address (OA).

9. An order server according to any of the claims 6 - 8, characterized in that the call (CL) contains an abbreviation (AB) corresponding to the order address (OA) or a short address (SA), and that the second confirmation (CN2) for the vehicle that sent the reply (RP) contains the order address (OA).

10. A vehicle terminal device to be connected to a mobile network for automatically ordering a vehicle (16, T1 - T10) meant for transporting people or goods, characterized in that the vehicle terminal comprises:

- means for receiving a call (CL) from the taxi center (TC) through a mobile telecommunications network (PLMN), said call indicating, at least roughly, the order address of the vehicle;

- means connected to the call receiving means in order to send at least a rough order address to the driver of the vehicle;

- means for acknowledging the call in order to receive the reception message from the driver;

- means connected to the acknowledging means in order to send a reply (RP) to the taxi center; and

- means for receiving a confirmation (CN2) from the taxi center; and

- means connected to the confirmation reception means in order to send a confirmation to the driver.

Fig. 1

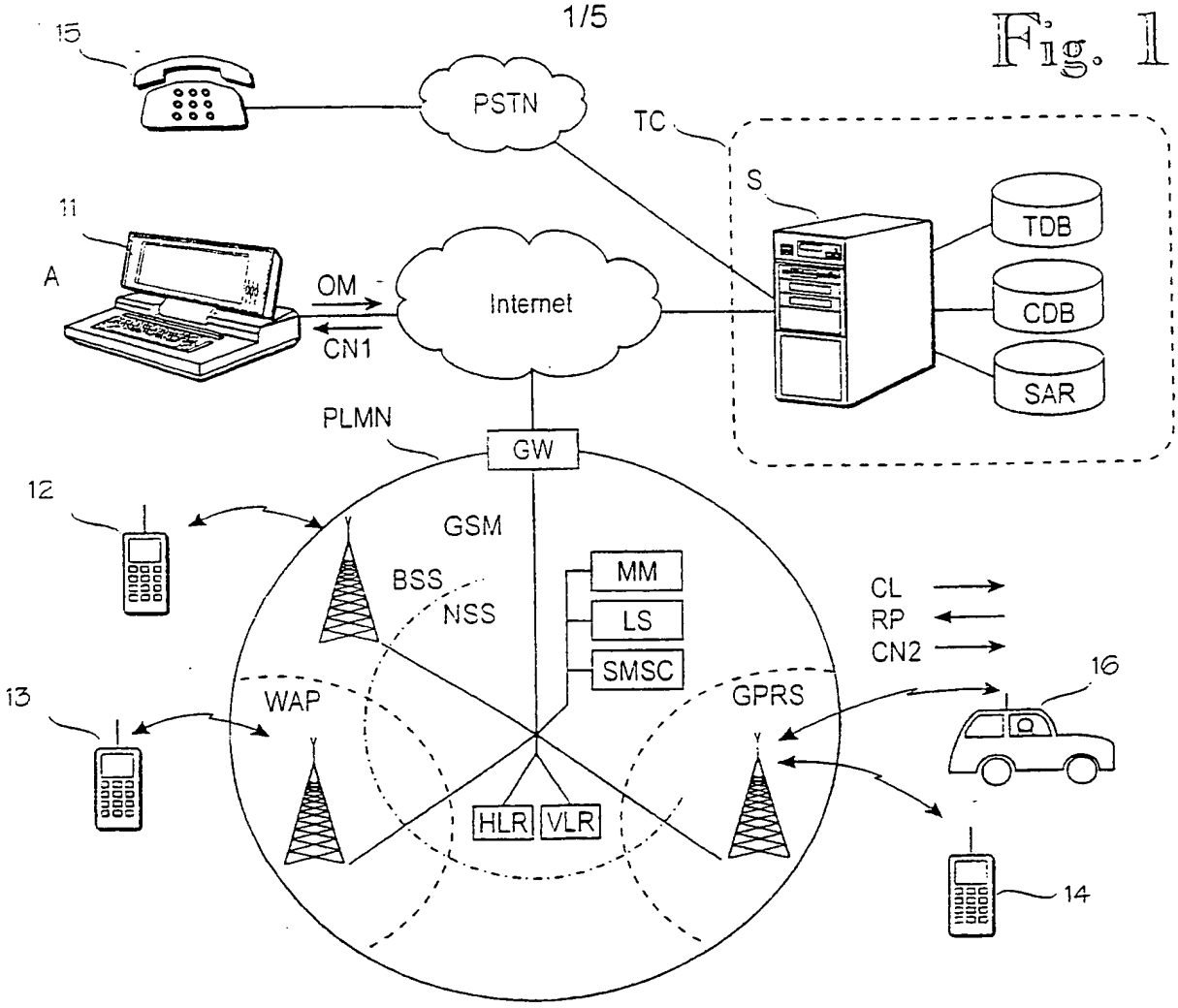

15
PSTN
TC
S
TDB
CDB
SAR
11
A
OM
CN1
Internet
PLMN
GW
12
GSM
BSS
NSS
MM
LS
SMSC
CL
RP
CN2
16
13
WAP
GPRS
HLR
VLR
14

Fig. 3

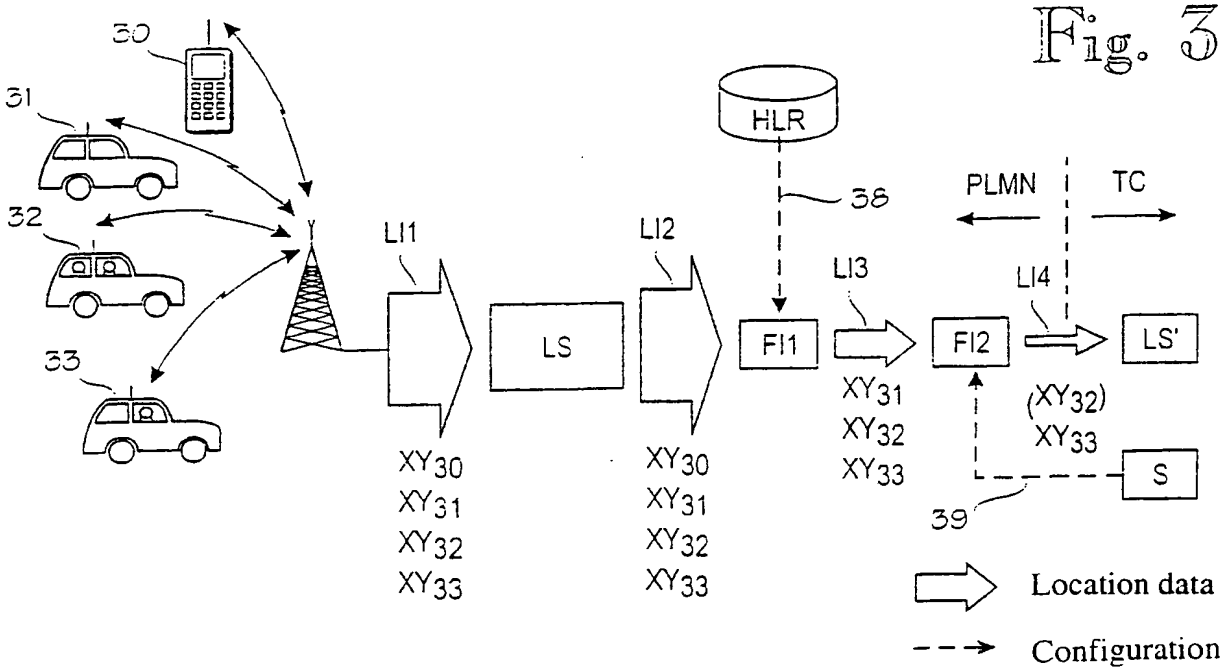
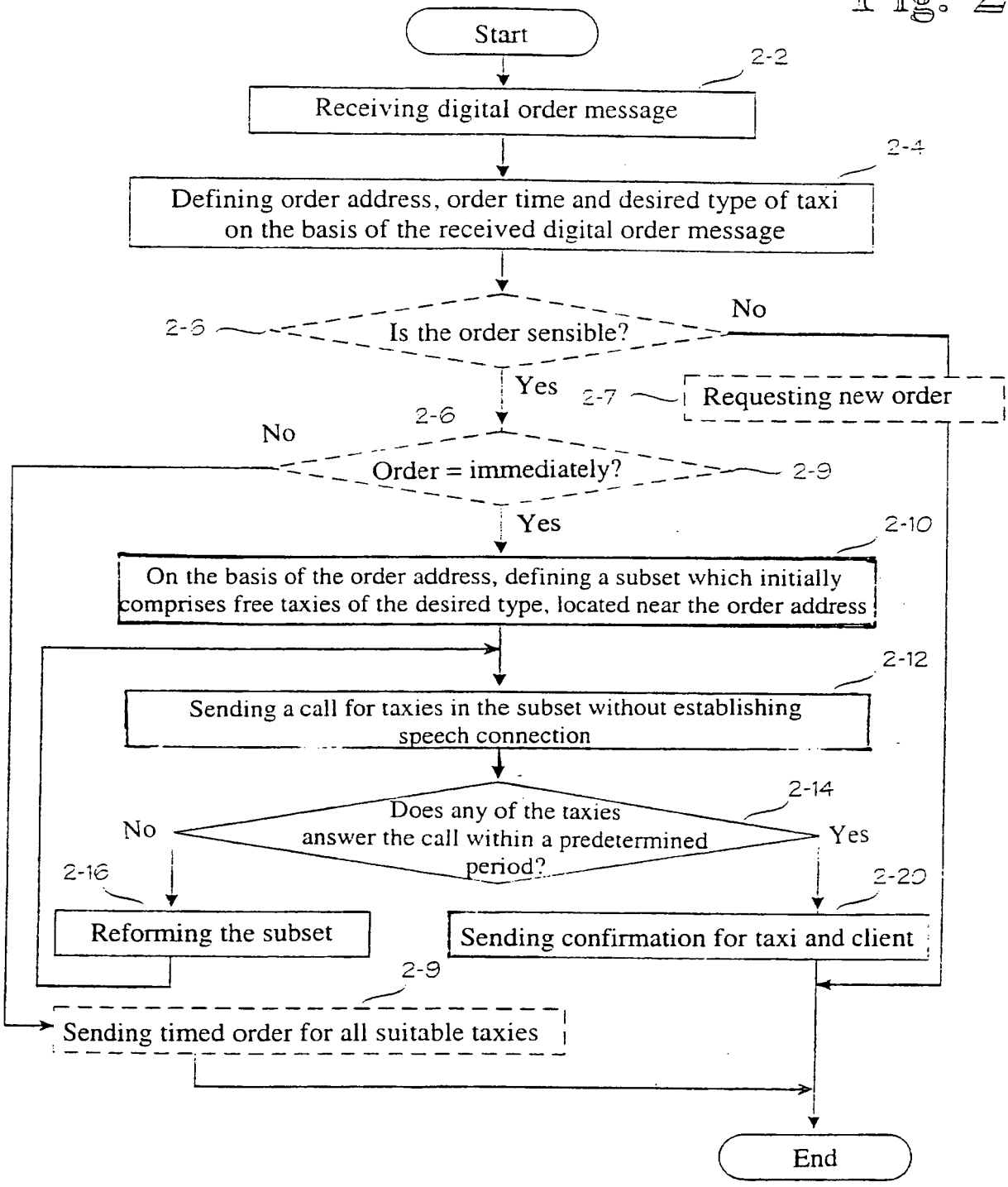

30
31
32
33
LI1
LS
LI2
HLR
38
PLMN
TC
LI3
LI4
FI1
FI2
LS'
S
39
XY30
XY31
XY32
XY33
(XY32)
Location data
Configuration

Fig. 2


Start
2-2
Receiving digital order message
2-4
Defining order address, order time and desired type of taxi on the basis of the received digital order message
2-5
Is the order sensible?
No
Yes
2-7
Requesting new order
2-6
No
Order = immediately?
2-9
Yes
2-10
On the basis of the order address, defining a subset which initially comprises free taxies of the desired type, located near the order address
2-12
Sending a call for taxies in the subset without establishing speech connection
2-14
Does any of the taxies answer the call within a predetermined period?
No
Yes
2-16
Reforming the subset
2-20
Sending confirmation for taxi and client
2-9
Sending timed order for all suitable taxies
End

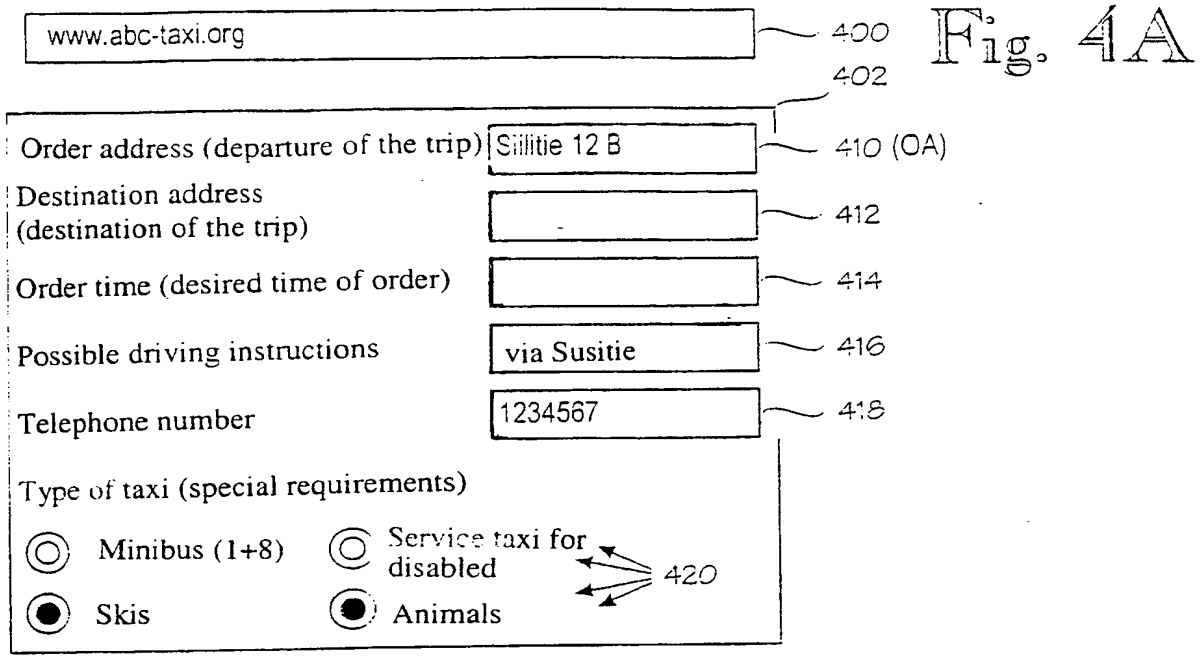


Fig. 4A

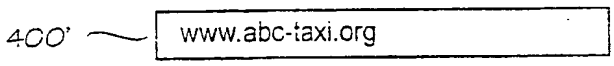


Fig. 4B

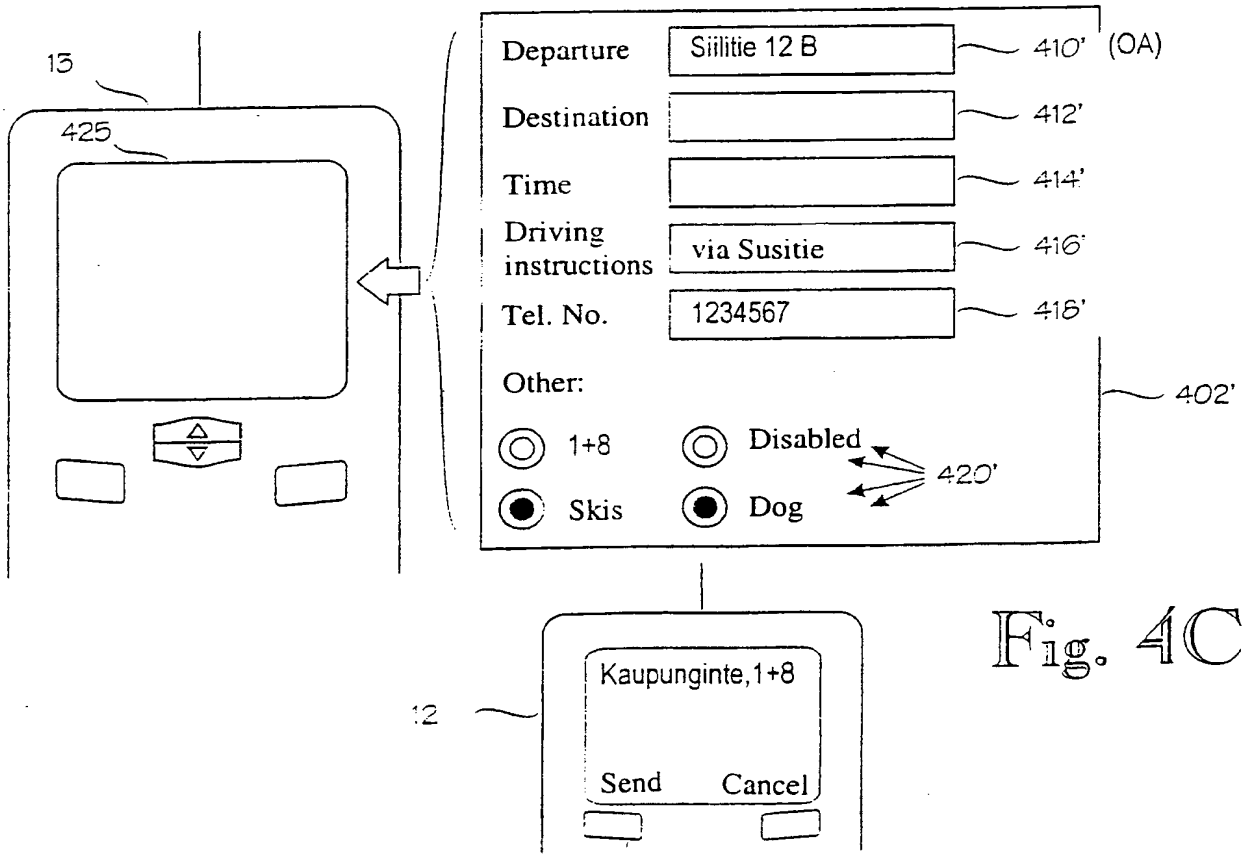


Fig. 4C

Fig. 5

TDB

No	LIC	ID	Type	Skis	Animal	In operation	Ready	X	Y
123	ABC-123	11223344	Norm/Inva/1+8	0/1	0/1	0/1	0/1	3456	5678

Fig. 6

SAR

Short address	Street address
City Theatre	Eläintarhantie 5
National Theatre	Railway Station Square
Opera	Helsinginkatu 58
Titanic	Itäinen Satamakatu 54
SA	OA

Fig. 7

CDB

...
Helsinki AB
...

Karhutie (H-niemi)	X, Y
1	7143,20011
2	7139,20010
61	7150,20692
72	7146,20694
69	7206,20720
80	7204,20721
75	7351,20850
88	7354,20856
139	7867,20886
140	7868,20890

...

OA: Karhutie 123

XY: 7738,20877

Fig. 9

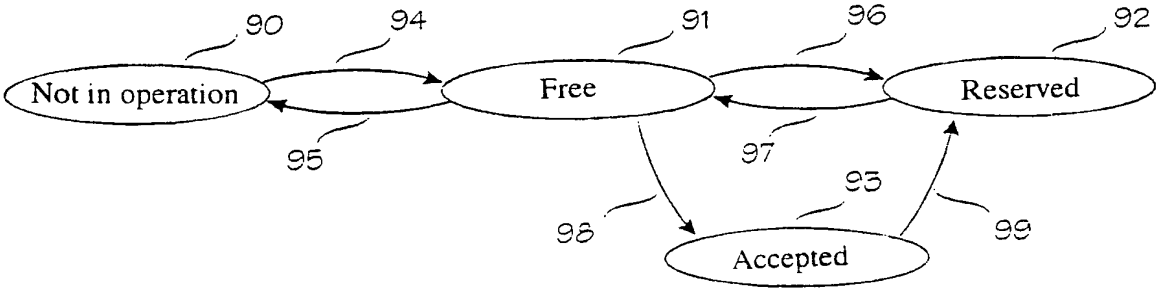


Fig. 8A

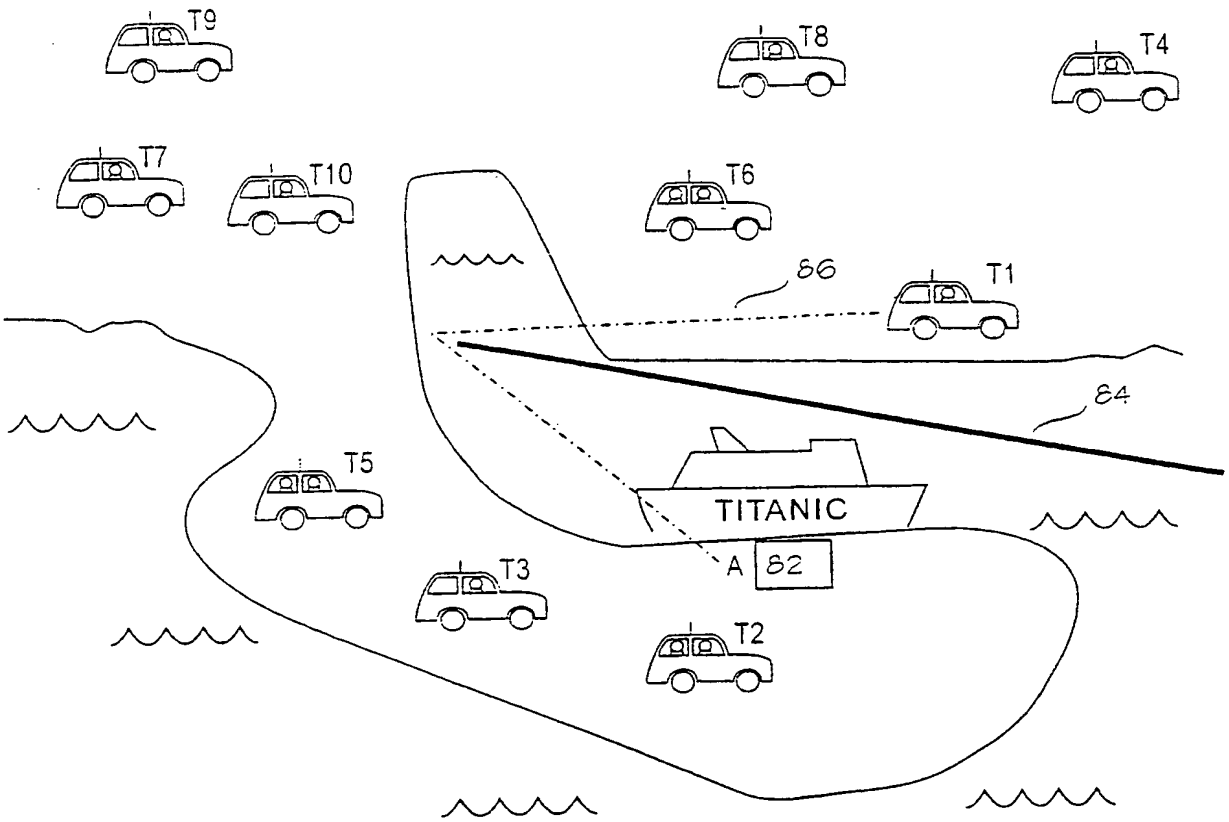
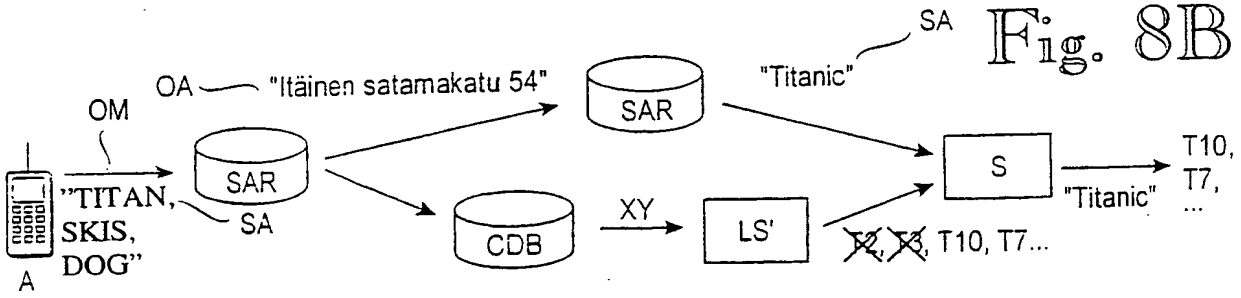


Fig. 8B



TDB

No	ID	Type	Skis	Animal	Ready
T1	9000001	Norm	1	1	1
T2	9000002	Norm	1	1	0
T3	9000003	Norm	0	0	1
T4	9000004	Norm	1	1	1
T5	9000005	Norm	1	1	0
T6	9000006	Norm	1	0	0
T7	9000007	Norm	1	1	1
T8	9000008	1+8	1	1	1
T9	9000009	Inva	1	1	1
T10	9000010	Norm	1	1	1

CDB

X	Y

INTERNATIONAL SEARCH REPORT

International application No.
PCT/FI 01/00285

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38, G08G 1/127
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: G08G, H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 9944186 A1 (JAFFE, SHAI), 2 Sept 1999 (02.09.99), abstract ---	1-10
A	WO 9933199 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 1 July 1999 (01.07.99), abstract ---	1-10
A	WO 9820309 A1 (SIRMANSHAHI, AFSHIN), 14 May 1998 (14.05.98), abstract ---	1-10
A	WO 8903106 A1 (SPECTRONICS MICRO SYSTEMS LIMITED), 6 April 1989 (06.04.89), abstract --- --------	1-10

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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Information on patent family members

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